Wild celery has been shown to tolerate salinities as high as 10 to 12 ppt. This species could occur in the upper reaches of the South and North Forks where freshwater stream inflows buffer high salinities during drought periods. An advantage of this species is that it tends to have a resilient reproductive system and may be capable of faster recovery from adverse conditions than the true seagrasses (Woodward Clyde International-Americas, 1998).

A primary limitation to restoration of SAV beds in the St. Lucie Estuary is the light available for photosynthesis (light requirements of key SAV species are shown in Table 7-1). Color is also an important consideration in the SLE. Chamberlain and Hayward (1996) found that the effect of color on transparency and light penetration in the SLE is almost twice that of total suspended solids (TSS) and an order of magnitude larger than chlorophyll-a. Turbidity and TSS in the estuary are moderate in concentration, but high color, organic acid, and organic matter content combine with the TSS to severely limit transparency and light penetration. Improvement of light penetration through restoration efforts, is needed to establish SAV in the St. Lucie Estuary.

Water Quality

Monitoring Networks

In addition to establishing limits for the quantity of water, the quality of water entering the estuary also deserves attention. A suitable salinity environment alone will not guarantee a healthy ecosystem. Optimum loading ranges for nutrients and other critical materials must also be established. The SFWMD has two long-term surface water quality monitoring networks in place to provide data on the SLE and its watershed. In 2001, two additional monitoring networks were established. A New surface water data collection network, SLT, covering 38 sites in the coastal urbanized portion of the watershed was initiated in November 2001 and a groundwater/surface water network, covering six sites, began operation in early 2002 (Table 7-2).

Water Quality Monitoring (WQM) Network.

The Upper East Coast WQM is a long-term, routine part of a SFWMD-wide monitoring network initiated in 1979 (Germain, 1998). Water quality information is collected at five (5) coastal structures located throughout Martin and St. Lucie counties. Additional information concerning this network is provided in Chapter 6.

St. Lucie Estuary (SE) Network.

As part of the SWIM initiative a long-term water quality-monitoring program was started in October of 1989 in the SLE. Ten water quality monitoring stations (SE 0 - SE 10) were established to detect long-term spatial and temporal trends in the SLE. Data were collected bi-weekly from October 1990 through December 1996 and monthly from January 1997 to August 2000 (Figure 7-9). For statistical analyses, the SLE was divided into three distinct segments, the North Fork (SE 05, HR1, SE 06, and SE 07), South Fork (SE 08, SE 09, and SE 10), and Middle Estuary (SE 01, SE 02, SE 03, and SE 04).

St. Lucie Estuary/South Indian River Lagoon Tributary (SLT) Network.

The SLT water quality monitoring network is a three (3) year program (2001 - 2003) to monitor water quality at 38 sites tributary to the St. Lucie River, the St. Lucie Estuary and the SIRL located in Martin and St. Lucie counties (Figure 7-10). All sites are sampled on a bi-weekly basis under flow conditions or sampled monthly regardless of flow.

Table 7-2. SLE Water Quality Monitoring Programs, sample frequencies and parameters

Project Code	WQM	SLT[1]	SE[2]	[3]GW/SW
Frequency	**Parameters**	**Parameters**	**Parameters**	**Parameters**
CONTINOUS DAILY				Physicals: Temp, Sp. Cond, pH, Salinity, DO
WEEKLY COMPOSITE	Nutrients: T-PO_4, NOx, NH_4 & TKN			
BI-WEEKLY		Nutrients/Other: T-PO_4, o-PO_4, NOx, NH_4, TKN, Chlorophyll Physicals: Temp, Sp. Cond, pH, Turb, TSS, DO		
MONTHLY	Nutrients: T-PO_4, o-PO_4, NOx, NH_4, TKN Physicals: Temp, Sp. Cond, pH, Turb, TSS, DO Ions/Metals: Ca, Mg, T-Cu, T-As, T-Cr, Hardness	Nutrients/Physical : Same as bi-weekly. Ions/Metals: Ca, Mg, T-Cu, T-As, T-Cr, Hardness	Nutrients/Other: T-PO_4, o-PO_4, NH_4, NO_2, NOx, TKN, VSS, Chlorophyll, Color, TSS, Turb. Physical: Temp, pH, Sp. Cond, DO, Salinity, PAR	Nutrients/Other: T-PO_4, o-PO_4, NH_4, NO2, NOx, TKN, Na, Mg, Ca, K, Cl, Fe, SO_4, Hard, TSS, DOC, TDS, TOC, Alk.,.

1 – SLT samples collected bi-weekly under flow conditions and sampled monthly regardless of flow.
2 – SE samples collected monthly.
3 – GW/SW Interactive Study currently monitors "Nutrients/Other" on a semi-annual basis. These parameters will be monitored quarterly starting October 2002. In addition, fecal coliform, nitrogen isotopes and methyl blue activated surfactants (detergents) will be collected quarterly starting in October 2002.

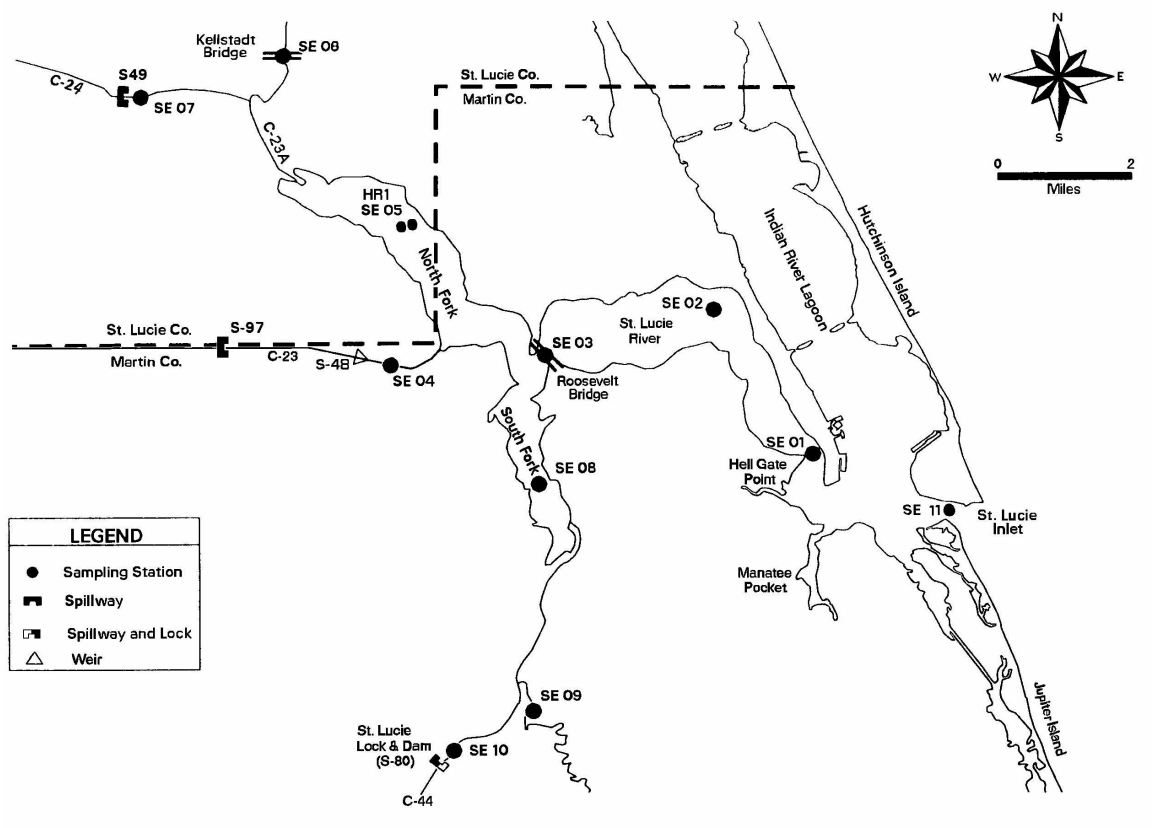

Figure 7-9. SE Water Quality Monitoring Network

Figure 7-10. SLT Monitoring Network for the St. Lucie Estuary

Groundwater - Surface Water (GW/SW) Network.

This new network was established at six sites to better understand contributions of groundwater input to the SLE&R and SIRL. Fifteen monitor wells were recently installed at six sites (see Figure 6-6 in Chapter 6). Chemical characterization of groundwater and surface water is key to understanding the exchange and movement of water (inflows and outflows) and spatial and temporal effects on the water, the aquifer, and solute movement to and from the aquifer and surface water. Analysis of the field parameters, major ions, iron, manganese, total organic carbon, dissolved organic carbon, total dissolved solids, and total suspended solids, will allow evaluation of water from different layers, sampling or analytical inconsistencies, and sampling problems. Analysis of nitrogen and phosphorous will address nutrient questions. Additional tests include Methyl Blue Activated Surfactants (MBAS), which measures surfactants in the water (an indicator of detergents) and can be used to show input from septic systems.

Water Quality Analyses

The University of Florida, IFAS, and IRREC under contract to the SFWMD recently completed a one-year monitoring contract focusing on water quality discharges from the western portion of the watershed. This study provided a higher resolution assessment of temporal trends in the movement of the selected pesticides from a predominately agricultural watershed (citrus and pastures) by collecting samples on a daily or every-other-day basis. *N*-methylcarbamoyloxime and *N*-methylcarbamate pesticides included: aldicarb, aldicarb sulfoxide, aldicarb sulfone, carabryl, methomyl, and oxamyl. Organophosphates are also measured, including azinphos-methyl, chlorpyrifos, diazinon, dimethoate, ethion, fenamiphos, malathion, and methidathion. All of these pesticides (except diazinon) were labeled for use in citrus production. The sampling site for this study was located at Gordy Road and Ten Mile Creek (see pictures).

Gordy Road Structure

North St. Lucie River Water Control District

All of the canals in the predominantly citrus-producing area within the North St. Lucie River Water Control District (NSLRWCD) normally drain by gravity through this discharge structure. This watershed encompasses approximately 65,000 acres. The NSLRWCD comprises the headwaters of Ten Mile creek. Water that passes through/over this structure goes into Ten Mile Creek, a tributary creek that discharges into the North Fork of the St. Lucie River Aquatic Preserve, an Outstanding Florida Water (OFW) body. Specific objectives of this study were to:

1. Identify whether selected pesticides were present in water leaving the NSLWCD
2. Characterize possible seasonal trends in movement of pesticides that were present.

Aldicarb, aldicarb sulfone, and aldicarb sulfoxide were detected in 16, 30, and 14 samples, respectively, from a total of 280 samples analyzed. Methomyl was detected in one sample and oxamyl was never detected between April 4th and September 30, 2001. Ethion and diazinon were present in 19 and 2 of 332 consecutive samples, respectively, analyzed between February

12, 2001 and February 12, 2002. No other organophosphate pesticides were detected. Copper and total phosphorus levels peaked during the summer months when discharges were greatest.

Recently, FDEP has been conducting Total Maximum Daily Load (TMDL) analyses in compliance with Section 303 (d) of the Clean Water Act. Other laws that relate to TMDLs include federal statutes 40 CFR 130.2 and 40 CFR 130.7 and Florida Statutes, 403.067. The purpose of the TMDL program is to identify causes and solutions to water quality impairment in water bodies and establish upper limits or ceilings on specific amounts of pollutants that the water body can incorporate and still meet standards. The first draft of this analysis was issued in December 2001. The FDEP has continued to identify portions of the SLE for inclusion on the impaired water body planning list for nutrients (303(d) listing) and dissolved oxygen, and may include other portions on the final list where long-term monitoring of nutrient concentrations has documented elevated concentrations (St. Lucie and Loxahatchee Basin Status Report: Draft, FDEP, 2001).

As part of an effort to evaluate potential toxic effects of contaminants borne in flows to the estuary on resident biota (macro-invertebrates), the Florida Department of Environmental Protection (FDEP) has collected quarterly samples for nutrients, pesticide and heavy metals at the near-tide structures on C-23, C-24, C-25, and C-44. In addition, the FDEP collected quarterly samples at the structures on Ft. Pierce Farms canal, at the Midway Road bridge on the North Fork of the St. Lucie River, and from a sampling point located upstream of the urban developed area on the South Fork of the St. Lucie River. The SFWMD and the FDEP water quality findings agree: inflows to the IRL and the SLE contain excessive concentrations of nutrients, as well as relatively frequent detections of pesticides and heavy metals. Pesticides at concentrations that exceed state water quality standards were detected in all monitored inflows except the historic South Fork St. Lucie River.

The SLE has periodically experienced outbreaks of fish lesions, large phytoplankton blooms, and periods of hypoxia in its bottom waters (Chamberlain and Hayward, 1996; Graves and Strom, 1992). In 1998 the Florida Department of Environmental Protection (FDEP) listed portions of the SLE as impaired water bodies, unable to support their designated uses, in the USEPA section 303(d) report, of the Clean Water Act. The North Fork St. Lucie River Aquatic Preserve (AP) is monitored regularly and Outstanding Florida Waters rules and water quality criteria are often violated for dissolved oxygen and turbidity. Agricultural and residential stormwater discharges negatively impact this preserve and algae looms are often observed.

Nutrient Enrichment

Table 7-3 provides summaries of dry season and wet season water quality data for commonly-monitored parameters, including nutrients, at 10 stations in the St. Lucie Estuary during the past nine years (SFWMD, unpublished). In contrast to other portions Indian River Lagoon, the St. Lucie Estuary shows signs of advanced eutrophication: changes to benthic community composition (loss of SAV and oysters), nuisance algal blooms, and periods of hypoxia (Chamberlain and Hayward 1996, Graves and Strom 1992, Gray 1992). Preliminary analysis of data collected during a recently completed productivity–benthic flux study indicate that nitrogen potentially limits primary productivity. Chlorophyll concentrations provide an indirect assessment of phytoplankton biomass, and an indicator of estuarine eutrophication (McErlean and Reed 1981, USEPA 1999). Reduction of chlorophyll is one of many factors needed to reestablish SAV in the St. Lucie and other degraded estuaries (Dennison *et al.* 1993). The latest draft of the Impaired Waters Report by FDEP has proposed a target annual average chlorophyll concentration of 11 µg/l.

Analyses conducted by the District indicate that chlorophyll-*a* concentrations in the St. Lucie are high relative to other estuaries that have displayed problems with water quality (Columbia River

Table 7-3 - SLE - Median Water Quality Parameters (Nine Year Data Set)

Parameters	Middle Estuary				North Fork				South Fork		
Dry Season											
STATION	**SE O1**	**SE 02**	**SE 03**	**SE 04**	**SE 05**	**HR1**	**SE 06**	**SE 07**	**SE 08**	**SE 09**	**SE 10**
DO mg/l	6.73	7.0	6.72	5.97	7.3	6.84	4.6	6.32	6.985	5.695	6.4
pH units	7.77	7.77	7.65	7.42	7.59	7.69	7.29	7.31	7.54	7.43	7.45
Salinity ppt	26.81	22.3	15.1	11.52	9.26	6.9	1.4	1	6.1	0.61	0.630
Secchi m	1.2	1.2	1	1	1	1.03	1	1	0.61	0.85	0.9
Chl *a* mg/m^3	4.8	5	6.4	7.7	7.2	9.6	9.3	8.65	8.35	8.4	7.6
NH_4 mg/l	0.02	0.02	0.02	0.057	0.005	9.6	0.04	0.078	0.038	0.022	0.062
NO_2 mg/l	0.002	0.003	0.002	0.005	0.002	0.002	0.004	0.006	0.006	0.006	0.009
NO_3 mg/l	0.018	0.032	0.059	0.065	0.026	0.012	0.067	0.031	0.064	0.069	0.153
NO_X mg/l	0.023	0.032	0.058	0.06	0.031	0.013	0.07	0.038	0.086	0.089	0.177
TKN mg/l	0.738	0.748	0.843	.964	0.92	1.062	1.02	1.117	1.087	1.01	1.1
ORGN mg/l	0.65	0.665	0.800	.905	0.88	0.987	0.97	1.015	0.995	0.99	1.025
TOTN mg/l	0.763	0.809	0.917	1.086	1.047	1.123	1.115	1.168	1.225	1.126	1.291
OPO4 mg/l	0.064	0.095	0.125	0.173	0.16	0.158	0.174	0.152	0.123	0.101	0.111
TP mg/l	0.072	0.094	0.132	0.167	0.139	0.2	0.215	0.203	0.181	0.155	0.172
TSS mg/l	19	14	14	10	8	8	7	5	13	8	9
Turbidity NTU	5	4.8	6.09	3.895	3.8	3.605	4.915	3.71	8.08	5	5.5
VSS mg/l	7	5	6	4	4	3	3	2	5	5	5.5
Color cu	23	31	40	56	56	50	64.5	74.5	56	65	60
Wet Season											
STATION	**SE O1**	**SE 02**	**SE 03**	**SE 04**	**SE 05**	**HR1**	**SE 06**	**SE 07**	**SE 08**	**SE 09**	**SE 10**
DO mg/l	5.6	5. 5	5.0	4.8	5.8	6.3	3.8	6.4	6.1	4.9	6.1
pH units	7.7	7.7	7.5	7.2	7.5	7.6	7.3	7.3	7.5	7.4	7.4
Salinity ppt	24	16	11	6.9	4.2	7	0.7	0.5	5.0	0.4	0.4
Secchi m	1.0	1.0	1.0	0.9	0.9	1.0	0.9	0.9	0.6	0.8	0.9
Chl *a* mg/m^3	5.8	7.2	10.2	9.3	12.4	12.1	10.2	8.9	9.5	10.3	9.2
NH_4 mg/l	0.070	0.059	0.050	0.102	0.022	0.030	0.046	0.119	0.044	0.022	0.071
NO_2 mg/l	0.002	0.005	0.006	0.006	0.005	0.002	0.005	0.007	0.008	7	0.020
NO_3 mg/l	0.012	0.023	0.021	0.026	0.008	0.008	0.069	0.019	0.045	0.051	0.107
NO_X mg/l	0.013	0.024	0.031	0.034	0.008	0.009	0.070	0.027	0.062	0.060	0.141
TKN mg/l	0.798	0.990	1.080	1.238	1.124	1.117	1.065	1.259	1.176	1.51	1.108
ORGN mg/l	0.700	0.860	0.970	1.103	0.999	1.026	0.999	1.122	1.065	1.010	1.045
TOTN mg/l	0.830	1.053	1.129	1.309	1.183	1.144	1.198	1.281	1.292	1.128	1.300
OPO4 mg/l	0.096	0.126	0.170	0.207	0.192	0.196	0.208	0.193	0.152	0.129	0.142
TP mg/l	0.126	0.165	0.207	0.264	0.232	0.229	0.262	0.268	0.206	0.175	0.203
TSS mg/l	14	12	11	6	7	7	7	5	11	7	7
Turbidity NTU	5.2	5.0	5.1	3.8	3.6	3.4	5.2	3.4	7.6	5.0	4.5
VSS mg/l	6	5	4	3	3	3	3	2	5	3	2
Color cu	31	51	63	89	91	53	77	87	70	78	71

Source: SFWMD, Unpublished

Estuary, Chesapeake Bay, and the Dutch Wadden Sea). These systems rank close to the annual average concentration seen in the St. Lucie Estuary (Boynton *et al.* 1995, Nienhuis *et al*. 1992, Nixon *et al.* 1986, NOAA 1997a, NOAA 1998, Philippart et al. 2000, Simenstad et al. 1994). The seasonal range is most similar to that in the upper Chesapeake Bay. According to NOAA (1997a, 1997b, 1998), these same systems continue to show peak chlorophyll-*a* levels that are "high" (20-60 µg/l) to "hypereutrophic" (>60 µg/l). While annual maximum values in the St. Lucie Estuary occur in the "high" range, they are more often "moderate" (5-20 µg/l) to "low" (<5 µg/l). According to Boynton *et al* (1982), systems where rivers serve as direct sources of water from the land are prone to have higher chlorophyll levels. Over the past decade, chlorophyll levels in the St. Lucie Estuary have increased at 2 of 11 sites and decreased at none, which suggests that there has been no general improvement in water quality.

Among many factors that control chlorophyll levels in estuaries, nutrient concentrations receive the most attention. In the St. Lucie and other estuaries where nitrogen is the limiting nutrient to phytoplankton growth, a high correlation between chlorophyll and this nitrogen might be expected to occur (Chamberlain and Hayward 1996, Day *et al.* 1989, Doering 1996, Smith *et al.* 1999). Boynton *et al.* (1982) and Monbet (1992) have demonstrated this relationship in many systems. No association between chlorophyll-*a* and available nitrogen (dissolved inorganic nitrogen, DIN) has been detected in the St. Lucie Estuary. Further analysis needs to be performed to clarify the exact relationship between nutrient loading and algal blooms in the SLE.

Temporal Analysis

The Middle Estuary shows an increase in NH_4 at three of four stations (SFWMD, unpublished). Color showed a negative trend in the middle estuary except at site SE 03. Site SE 03, at the confluence of the Middle, North and South Forks and adjacent to Roosevelt Bridge, shows a increasing concentrations of ammonia, organic nitrogen and color. Site SE 06 in the North Fork south of the Kellstadt Bridge showed decreasing trends in NO_2, NO_3, NO_X, TSS, TURB, VSS, and Color and increases in chlorophyll (Chl *a*) and TP. At HR1, an *in situ* continuous recording station and grab site, trends for salinity, TSS and VSS increased and the trend for color decreased. SE 07, located east of S-49 in the North Fork, showed an increase in Chl *a*. In the South Fork, color showed a significant negative trend for color at all stations. Significant increases of TP at SE 08 and DO at SE 09 (located in the Old South Fork) also occurred.

Spatial Analysis

Concentrations of TKN, TOTN, TP, color, ORGN, Chl *a*, tended to increase from the mouth of the SLE West into the North and South Forks during both the wet and dry seasons (SFWMD, unpublished). Conversely the concentrations of TSS, NH_4, DO and Salinity decreased from the mouth of the SLE with no significant change for NOX. Total suspended solids also decreased from the mouth to the head of the estuary. However, TSS was unusually high at SE 08(km = 17). This station is on a shoal where wind driven re-suspension is common.

Seasonal Values

Median seasonal values in the SLE (Table 7-3) indicate that nutrient laden water consistently comes from the North and South Forks (SFWMD, unpublished). This was based on samples from Kellstadt Bridge (SE 06), the most northerly station, which often had higher nutrient concentrations than samples from SE 07 in the C-24 basin adjacent to S49. In the South Fork, SE 09 and SE 10 consistently input poorer water quality into the SLE. Dry season salinities (Figure 7-11a and b) ranged from a high of 26.81 ppt at SE 01 to a low value of 1.0 ppt at SE 07 in the North Fork and 0.63 ppt at SE 10 in the South Fork. Conversely, median wet season salinities ranged from a high of 24 ppt at SE 01 to lows of 0.7 ppt at SE 06 in the North Fork and 0.4 ppt at SE 10 in the South Fork. TSS values in the wet season ranged from 14 mg/l at SE 01 to 7 mg/l in the North Fork at SE 05 and in the South Fork a high of 11 mg/l at SE 08 and 7 mg/l at SE 10. Mean DO values were generally above 5 mg/l except that wet season values at stations SE 04 and SE 06 were 4.02 mg/l and 3.83 mg/l, respectively. With the exception of NO_x, the various forms of nitrogen (TKN, TOTN, NH_4, and ORGN) had higher concentrations in the wet season (May through October) then during the dry season (November through April) (Doering 1996). Color, TP and OPO_4 also exhibited this pattern (Figure 17-12a and b).

Dissolved Oxygen

Dissolved Oxygen values have been a source of concern in the SLE. The Environmental Protection Agency sets guidelines for hypoxic waters as >2 mg/l and ≤5mg/l and anoxic waters as ≤2mg/l. Using these guidelines, Figure 7-13 shows the normalized distribution of DO in the SLE by station. Figure 7-14 shows the number of samples taken over time and the distribution

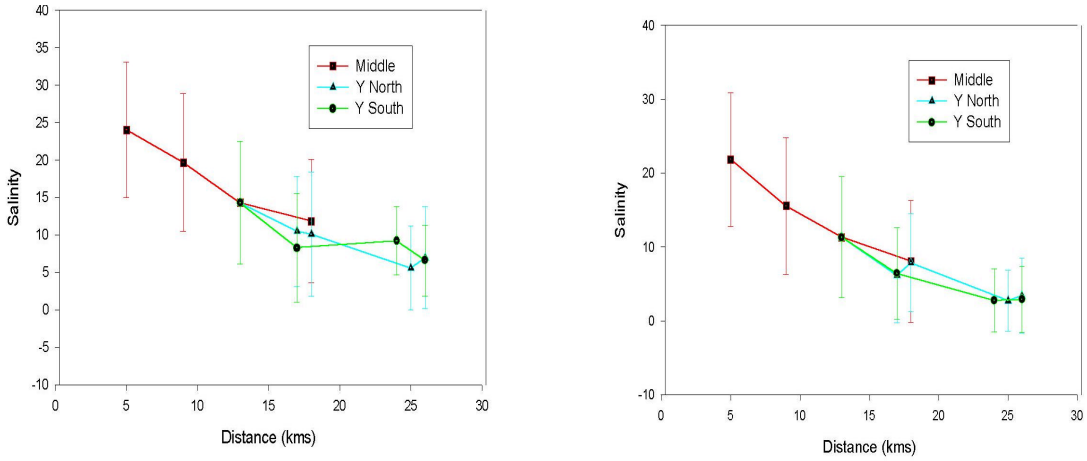

Figure 7-11. Dry Season (left) and Wet Season (right) salinities in the St. Lucie Estuary

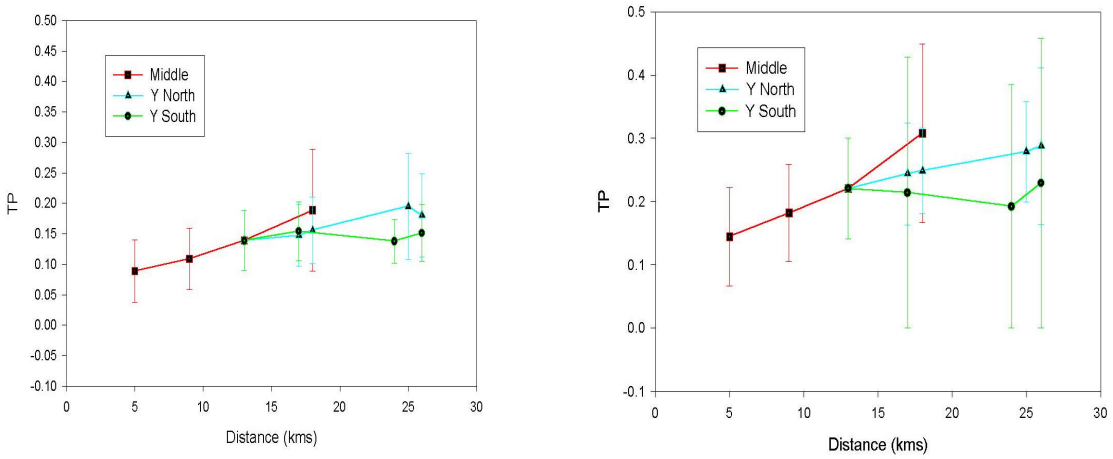

Figure 7-12. Dry Season (left) and Wet Season (right) TP in the St. Lucie Estuary

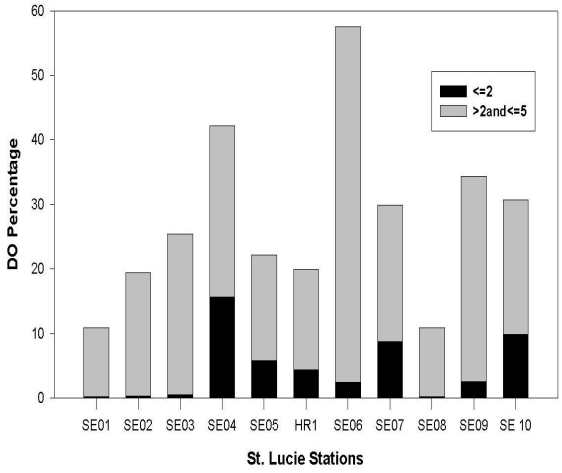

Figure 7-13. DO Bottom Percentages

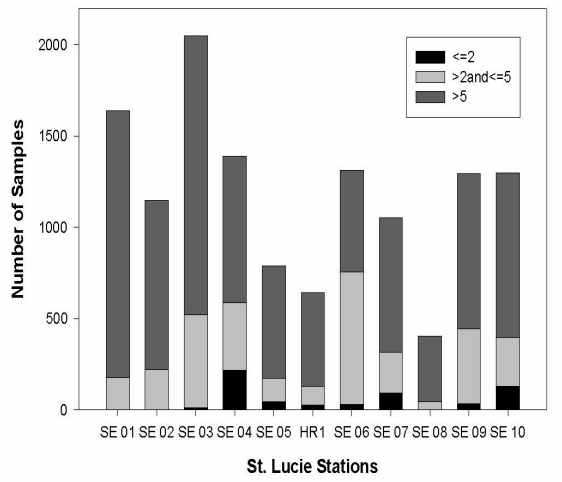

Figure 7-14. Sample Counts

of DO concentrations by station based on EPA criteria. All DO samples were taken between 0900h. and 1600h. DO values tended to decrease as you move West toward the North and South forks where the majority of fresh water inputs are located.

General Trends

Excepting TSS, the concentrations of most water quality parameters decreased in a westerly direction from the mouth of the SLE due to nutrient laden freshwater inputs from both the North and South Forks. In most cases the water quality of the South Fork appears similar to the water quality of the North Fork although they drain different basins. Increased freshwater inputs during the wet season through the North and South Forks of the SLE tend to explain the majority of the seasonal variability (Doering, 1996).Hand *et al* (1994) established median water quality standards for four parameters; Chl *a* (9 µg/l), TOTN (0.8 mg/l), TP (0.01 mg/l), and Secchi depth (1.1m) for Florida Estuaries. Total nitrogen and TP values for the SLE far exceeded the median values for comparable Florida estuarine systems. These values can be attributed to increased nutrient laden fresh water inflows (Chamberlain and Hayward, 1996). The SLE values for Chl *a* and Secchi depth were comparable to the water quality values derived by Hand *et al* (1994). Chamberlain and Hayward (1996) found that the highest Chl *a* values were associated with low flow and low nutrient and color concentrations. At low flow, flushing time is long and light availability is high. These conditions favor the accumulation of Chlorophyll biomass.

Dissolved oxygen is a critical indicator of ecosystem health. Most stations in the North and South fork of the SLE exhibit hypoxia and some stations exceeded EPA standards more then 20 percent of the time over the last decade. These values were taken during the day, when DO values are typically higher. DO values at night could be significantly lower. Stations co-located with structures tended to have high exceedances of hypoxic and anoxic conditions due to the stratification between fresh and brackish waters under low or no flow conditions. The sites of concern are the stations that are not adjacent to structures and still exhibit hypoxic profiles.

Progress of Projects

Seagrass and Oyster (VEC), Water Quality, and Bathymetry Projects

Current status, description and lead agencies for these projects are summarized in Table 7.4. A literature review of the history of seagrass and oyster populations and a survey of SLE seagrass and oyster distributions is complete. Thirteen projects are related to monitoring of bottom communities and water quality, of which five have been completed. Bathymetry of the estuary has been determined and the North Fork River will be mapped in 2003.

Major Water Quality Improvement Projects

A large number of water resources projects are currently underway in the SLE Watershed. Many of these projects, such as; stormwater retrofits, implementation of best management practices (BMPs), sediment removal, and habitat restoration, etc., can immediately contribute to the achievement of SWIM goals and objectives. Other projects have longer-term implications for the IRL or SLE, i.e., Implementation of IRL - South Feasibility Study and the Lake Okeechobee Restoration Plan, major stormwater improvement projects. Projects nominated by the St. Lucie River Issues Team have received more than $53 million, including $26.5 million came from the State's Florida Water Resource Projects (FWAP) process or state allocations, and more than $26.5 million from matching county, city, state and federal sources. This state/ local/federal cooperation has greatly accelerated implementation of many of the projects. The Issue Team has successfully funded 88 projects from 1999-2002.

Table 7-4. Seagrass and Oyster (VEC)/Water Quality/Bathymetry Projects

Project Name	Description	Status	Lead Agency
Historical Assessment			
SLE Seagrass & Oyster Literature Review 1998	Contract with Woodward-Clyde for literature review of history of seagrass and oyster populations in the SLE and data on substrates and salinity requirements for restoration.	Completed	SFWMD
Community Modeling			
Survey and Modeling of Oyster & Seagrasses in the SLE – 1999.	Contract with URS Greiner Woodward-Clyde for field surveys, bathymetry, GIS coverages, mapping, and modeling, to determine current distribution of oysters and seagrasses and forecast potential strategies for restoration .	In progress	SFWMD
Habitat and Water Quality Monitoring			
SLE Oyster Bed Monitoring	Periodic field inspection to note health and distribution.	Continuing	SFWMD
Seagrass Bed Monitoring	Periodic field inspection to note health and coverage	Continuing	SFWMD
SE Water Quality Monitoring Network	Ten stations located in SLE, North & South Forks, monitored monthly, from 1990 – 1996.	Completed	SFWMD
SE Water Quality Monitoring Network	Ten stations located in SLE, North & South Forks, monitored bi-weekly 1997 to present.	Continuing	SFWMD
WQM Water Quality Monitoring Network	Long term monitoring at five SFWMD coastal structures, 1979 to present.	Continuing	SFWMD
SLT Water Quality Monitoring Network	Three year project monitoring 38 watershed sites tributary to the SLE & IRL, 2001 - 2004	On-going	SFWMD
GW/SW Water quality Monitoring Network	Six groundwater/surface water stations, 4 @ SLE & 2 @ IRL, 2002.	Continuing	SFWMD
SLE Tide/Salinity Station Network	Three stations located in SLE, 1997 to present.	Continuing	SFWMD
SLE Water Quality Data Summary	Trend analysis and summary of SLE water quality data, 1990 –1999.	Completed	SFWMD
Organophosphate, Carbamate, Urea, & Metallic Pesticides Monitoring	Contract with IFAS, IRREC, for 12 month data set from water quality monitoring at the Gordy Road structure in St. Lucie County, 2001-2002.	Completed	SFWMD
FDEP Water Quality Monitoring Network 1998 - 2000	Periodic event sampling associated with development of criteria for referencing watershed land use and water quality indices.	Completed	FDEP @ PSL
Martin County Water Monitoring Network	15 gauges at 12 sites rainfall, groundwater, and stage data. Initiated January 2000.	Continuing	Martin County
Canal Watch Surface Water Quality Monitoring Network 2002	IFAS, IRREC, monitoring network covering sites in Martin and St. Lucie counties to provide baseline data for evaluating water quality impacts of BMP implementation..	In progress	IFAS, & FDACS
Bathymetry Studies			
SLE Bathymetry	Determine depth profiles throughout the estuary	Completed	SFWMD
North Fork Bathymetry	To be performed in 2003	In Progress	SFWMD
Herbicide Effects on SAV			
Effects of Herbicides on tapegrass	IFAS 2001-2002. Contract with IFAS for bioassay of herbicide impacts. Details to follow.	In progress	SFWMD

See the Issues Team 2001 report at http://www.sfwmd.gov/org/exo/mslsc and Figure 6-4 and Table 6-6 in Chapter 6 for more project details, locations and rankings. In addition, partnerships with Martin and St. Lucie counties and local municipalities have helped to accelerate progress on longer-term restoration/retrofit projects. Martin County has devoted extensive funding, through it's "Healthy Rivers" Tax to partner with the state and SFWMD to purchase properties with significant regional impact, such as Atlantic Ridge, Allapattah Ranch and Tenmile Creek Water Preserve Area, which are discussed later in this chapter.

Pollution Load Reduction Goal (PLRG) Development.

In the SLE a two-step approach is being taken to develop PLRG's. The first step was to develop interim concentration targets based on work done to support the IRL–South Feasibility Study (IRL SFS). The primary goal of the project is regulation of freshwater flows to maintain optimum salinities in the SLE. The SFWMD has developed freshwater flow targets based on salinity preferences of oysters and seagrasses. However, to maximize overall water quality benefits, nutrient and contaminant loads in freshwater flows to the estuaries must also be reduced. The IRL SFS water quality subteam recommended establishment of phosphorus reduction goals, since facilities designed to treat for phosphorus could also remove inorganic nitrogen, heavy metals, and pesticides, as well. The subteam produced a comparison of St. Lucie Estuary median nutrient concentrations versus those of all other Florida estuaries for the 19-year period of record from 1980 to 1998, as shown in Table 7-5. Only total nitrogen and total phosphorus had elevated levels. However, the median phosphorus concentration of 101 ppb for Florida's estuaries reflects a bias because several Florida estuaries, especially on the west coast, have high phosphorus levels due to phosphate mining activities in their basins. More recent data (1989-1998) indicate that the median total phosphorus concentration in Florida's estuaries is 81 ppb (Hand 1999).

Table 7-5. Median nutrient values for all Florida estuaries and St. Lucie Estuary (1980-1998 combined FDEP and SFWMD data set). All units in ppb.

	All Florida Estuaries	St. Lucie Estuary
Total P	101	192*
Total N	630	927
Ammonia N	30	30
Nitrate/nitrite N	30	30
Color	73	52
Chlorophyll *a*	5	7.7

***Note: Median of annual median values presented to reduce bias from intensive sampling in some years.**

Recent estimates of total phosphorus in St. Lucie Estuary were over 190 ppb. Thus, despite the bias, total phosphorus in the St. Lucie is well above the state's median. To meet the 81 ppb target requires a 50% or greater decrease in phosphorus loads. The subteam recommended an annual average phosphorus concentration of 81 parts ppb at low ebb tide at Roosevelt Bridge (see the Draft IRL SFS Report and Supplemental EIS, Appendix A, pp 90 – 101). The next step will be to use these target values with the hydrodynamic/water quality and watershed models to develop PLRGs for particular basins. Water quality concentration targets will be reevaluated and may be modified as additional water data and modeling results become available.

Stormwater Discharge Management Projects

As previously noted long-term solutions to damaging freshwater discharges to the South IRL will be addressed through CERP projects, specifically, the IRL South Plan, and the Lake Okeechobee Restoration Plan. However, implementations of major stormwater projects, such as, Ten Mile Creek Water Preserve Area, by the U.S. Army Corps of Engineers (USACOE) and the SFWMD, and projects currently under way by local governments will have significant positive impacts. Water quality impacts to the SLE are dominated by stormwater runoff from urban and agricultural sources. Several strategies are being implemented in the SLE watershed to better manage urban and agricultural runoff. Implementation of best management practices is on-going. Stormwater utilities are in place in each county. Counties, municipalities, and other agencies in the watershed are implementing a variety of stormwater retrofit projects. Funding provided through the St. Lucie River Issue Team program has assisted many of these efforts (Table 6-6). Additional information on these projects is provided in Table 7-6.

Table 7-6. Pollutant Load Reduction - Non-point Sources - Stormwater Projects

Project Name	Description	Status	Lead Agency
Local Government Projects- - St. Lucie County			
Platt's Creek / Sunrise Blvd. Stormwater – Habitat Restoration Project	Decommissioning and floodplain restoration of a 102 acre citrus grove on the North Fork of the St. Lucie River. Construction of a 16 acre wet detention area for stormwater quality improvement from the 1,000 acre watershed.	In progress	St. Lucie County
Indian River Estates Storm-water – Savannas State Preserve Restoration	Indian River Estates (IRE0 subdivision is located adjacent to the Savannas State Preserve. IRE presently discharges poor quality stormwater through a swale system to the preserve.	In progress	St. Lucie County
Hidden River Estates Retrofit	Provide retention area for existing 70-acre drainage basin that discharges directly to the North Fork of the St. Lucie River	In progress	St. Lucie County
C-23 and 28 Basin retrofit	Provide water control structures for drainage basins of 1400 acres that currently discharges to the North Fork St. Lucie River	In progress	St. Lucie County
River Park Baffle Boxes	Provide enhanced stormwater discharge for 150 acre basin that drains to the North Fork St. Lucie River	In progress	St. Lucie County
Local Government Projects- - City of Stuart			
Frazier Creek Stormwater Retrofit	Multi-phase project for sediment removal, stormwater detention and retention facilities, exotic removal and habitat restoration.	Completed	City of Stuart
Poppleton Creek Basin Stormwater Retrofit and Restoration Project	Multi-purpose project involving sediment removal, a retention and flow through marsh, exotic removal and habitat restoration, additional land acquisition for native habitat preservation.	In progress	City of Stuart
Haney Creek Basin Stormwater Retrofit and Restoration Project	Multi-purpose project involving water quality treatment improve-ments for stormwater, a retention and flow through marsh, exotic removal and habitat restoration, additional land acquisition for native habitat preservation, passive recreation , and education.	In progress	City of Stuart
Kruger Creek Stormwater Retrofit	This project involved sediment removal, installation of baffle boxes at storm sewer outfalls to the SLE.	Completed	City of Stuart
The Pine Riverdale Stormwater retrofit	This project is in an older section of the City with limited options for stormwater treatment. Baffle boxes have been installed and a dry retention areas is under consideration.	In progress	City of Stuart
Fork Road Basin Stormwater Retrofit and Restoration Project	This project is located in an older developed area of the City and proposes using an existing remnant wetland for improved stormwater treatment.	In progress	City of Stuart
The Anchorage Basin Project	Multi-purpose project involving water quality treatment improve-ments for live aboard boats anchored in the SLE. It provides a controlled mooring area and requires visiting boaters to register and utilize sanitary pump out facilities. The project also involved construction of harbormaster residence, ship store, showers and other amenities for passive recreation and education.	Completed	City of Stuart
Local Government Projects- - Martin County			
Willoughby Creek Project	Combination sediment removal and stormwater improvement project. Approximately 40,000 cubic yards of material will be removed improving water quality and navigation.	In progress	Martin County
Palm Lake Stormwater Retrofit Project	A 125 acre project to improve flooding and water quality through improvement of swales and renovation of an existing retention pond.	In progress	Martin County
Old Palm City Stormwater Retrofit	A multi phase project that provides renovation of existing facilities and construction of new discharge and retention facilities. The project includes exotic removal and habitat restoration.	In progress	Martin County
Poinciana Gardens Stormwater Retrofit	A 188 acre project consisting of swale improvements new retention facilities and enhancement of wetlands.	In progress	Martin County
Martin County GIS	Geographic Information Systems (GIS) work to support a storm water management program	Completed	Martin County

Table 7-6. Pollutant Load Reduction – Stormwater Projects (Cont.)

Project Name	Description	Status	Lead Agency
Local Government Projects- - Martin County (Continued)			
Fishermans Cove Stormwater Retrofit	A multi-phase project to provide improved water quality treatment of stormwater and flood control relief to existing residential areas within the 2,075 acre watershed.	In progress	Martin County
Airport Ditch Project	A joint Martin County and City of Stuart project to provide improved water quality treatment of stormwater and flood control relief to existing residential areas within this heavily urban basin.	In progress	Martin County & City of Stuart
Coral Gardens Basin Water Quality Retrofit	Proposed water quality retrofit improvements include a 6.4 acre lake and a 3.2 acre STA designed to improve basin stormwater hydraulics and reduce sediment and nutrient loading to the S. Fork of the St. Lucie River and the SLE.	In progress	Martin County
Fern Creek Water Quality Retrofit/Wetland Diversion	Proposed water quality retrofit improvements, including a retention/detention area , wetland flow through marsh, creek protection, channel stabilization, and baffle box installation, to provide water quality treatment and a reduce flow to the SLE	In progress	Martin County
Rio Water Quality Retrofit	Improve stormwater treatment for a previously developed area that discharges directly to the SLE through an uncontrolled culvert, by providing increased retention in an existing pond, new facilities and a control weir.	In progress	Martin County
Palm City Farms Retrofit	Enhanced stormwater management and improve water quality in Bessey and Danforth Creeks by improving basin stormwater hydraulics and reducing sediment and nutrient loading to the S. Fork of the St. Lucie River and the SLE.	In progress	Martin County
Regional Projects			
Baffle Box Installation	Installation of baffle boxes as a stormwater BMP in the urban and coastal areas of Martin and St. Lucie counties.	Ongoing	Counties and cities in UEC
Know The Flow Program	This program provides the public with information on the hydrologic cycle, the function of primary and secondary water control systems. Emphasis is placed the design and operation these systems and the role that homeowner associations and individual residents must play in maintaining their stormwater systems for flood control and water quality benefits.	Continuing	SFWMD
Adopt A Drop Program – Pilot Projects started in 2001.	St. Lucie River Initiative program that gathers information on non-point source pollution from established residential neighborhoods and businesses, in order to identify potential improvements through voluntary changes and local government retrofit projects.	On-going	St. Lucie River Initiative
Florida Yards & Neighborhoods	Education and training for the public to identify water quality and water conservation improvements that can be made through voluntary changes in residential and commercial lawn and garden care.	Continuing	IFAS/ St. Lucie and Martin County Extension
2004 Upper East Coast Watershed Symposium	The symposium is intended to present the status of activities programs or projects in the watershed aimed at achieving water quality and environmental progress. Interested individuals and organizations may include farmers, private landowners, commercial businesses, watershed and environmental interest groups, engineers, academicians, community leaders, county/city planners, commissioners, recreational water users, and members of the general public.	In progress	SFWMD